THE

ARITHMETICAL TABLE-BOOK;

OR

THE METHOD

OF

TEACHING THE COMBINATIONS OF FIGURES BY SIGHT.

BY

CHARLES DAVIES, LL.D.

AUTHOR OF ELEMENTARY ALGEBRA, ELEMENTS OF SURVEYING, ELEMENTS OF DESCRIPTIVE GEOMETRY, SHADES, SHADOWS, AND PERSPECTIVE, ANALYTICAL GEOMETRY, AND DIFFERENTIAL AND INTEGRAL CALCULUS.

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PREFACE.

In my University Arithmetic, published in 1846, Arithmetic is treated as a science, having its own peculiar language. The alphabet of that language is the ten characters called figures. The combinations of these characters, according to certain laws, afford the means of expressing every idea connected with the science of numbers. The language of arithmetic is but the result of these combinations.

The train of reflections thus suggested induced me to believe that elementary arithmetic might be taught by this method with great success, and a recent visit to the schools in Providence, Rhode Island, under the care of Mr. N. Bishop, City Superintendent, and a corps of very able teachers, has fully confirmed me in that impression.

The author is much indebted to Mr. Bishop, and to the teachers acting in conjunction with him, for many valuable suggestions. Indeed, but for their favorable opinion of the method here illustrated, verified by satisfactory experiments, this Elementary Book, presenting the subject of numbers to the minds of children in a new light, would not have appeared in its present form.

CHARLES DAVIES.

New York, *April*, 1848.

PLAN OF THE WORK.

The leading feature of the plan is to teach the reading of figures; that is, so to train the mind that it shall, by the aid of the eye alone, catch instantly the idea which any combination of figures is intended to express.

The method heretofore pursued has aimed only at presenting the combinations by means of our common language: this method proposes to present them purely through the arithmetical symbols, so that the pupil shall not be obliged to pause at every step and translate his conceptions into common language, and then re-translate them into the language of arithmetic.

For example, when he sees two numbers, as 4 and 8, to be added, he shall not pause and say, 4 and 8 are 12, but shall be so trained as to repeat 12 at once, as is always done by an experienced accountant. So, if the difference of these numbers is to be found, he shall at once say 4, and not 4 from 8 leaves 4. If he desires their product, he will say 32; if their quotient, 2: and the same in all similar cases.

This is all to be done by *the simple process of reading;* and the method consists,

1st. In teaching the alphabet, and

2dly. In teaching the combinations of the alphabet, which become the exponents or signs of ideas.

After this is done, the pupils of a class should be taught to read together, all the combinations, in the same manner as they practise reading lessons in our common language.

PRIMARY TABLE BOOK.

LESSON I.

Counting.

One, ... *
Two, ... * *
Three, ... * * *
Four, ... * * * *
Five, ... * * * * *
Six, ... * * * * * *
Seven, ... * * * * * * *
Eight, ... * * * * * * * *
Nine, ... * * * * * * * * *
Ten, ... * * * * * * * * * *
Eleven, ... * * * * * * * * * * *
Twelve, ... * * * * * * * * * * * *
Thirteen, ... * * * * * * * * * * * * *
Fourteen, ... * * * * * * * * * * * * * *
Fifteen, ... * * * * * * * * * * * * * * *
Sixteen, . . . * * * * * * * * * * * * * * * *
Seventeen, . * * * * * * * * * * * * * * * * *
Eighteen, . * * * * * * * * * * * * * * * * * *
Nineteen, * * * * * * * * * * * * * * * * * * *
Twenty, *

LESSON II.

Figures from One to Twenty.

1	. . . . . *
2	. . . . . * *
3	. . . . . * * *
4	. . . . . * * * *
5	. . . . . * * * * *
6	. . . . . * * * * * *
7	. . . . . * * * * * * *
8	. . . . . * * * * * * * *
9	. . . . . * * * * * * * * *
10	. . . . . * * * * * * * * * *
11	. . . . . * * * * * * * * * * *
12	. . . . . * * * * * * * * * * * *
13	. . . . . * * * * * * * * * * * * *
14	. . . . . * * * * * * * * * * * * * *
15	. . . . . * * * * * * * * * * * * * * *
16	. . . . * * * * * * * * * * * * * * * *
17	. . . * * * * * * * * * * * * * * * * *
18	. . * * * * * * * * * * * * * * * * * *
19	. * * * * * * * * * * * * * * * * * * *
20	* * * * * * * * * * * * * * * * * * * *

Which figure stands for two? Which figure stands for four? Which figure stands for nine? Which stands for eight? What stands for ten? What stands for twelve? What stands for fourteen? What stands for sixteen? What stands for eighteen? What stands for twenty? What stands for seventeen? What stands for fifteen? What stands for nineteen? What stands for eleven? What stands for thirteen?

LESSON III.

Figures from One to One Hundred

Naught . .	0	Thirty-four	34	Sixty-eight	68
One . . .	1	Thirty-five	35	Sixty-nine	69
Two . . .	2	Thirty-six	36	Seventy	70
Three . .	3	Thirty-seven	37	Seventy-one	71
Four . . .	4	Thirty-eight	38	Seventy-two	72
Five . . .	5	Thirty-nine	39	Seventy-three	73
Six . . .	6	Forty . .	40	Seventy-four	74
Seven . .	7	Forty-one .	41	Seventy-five	75
Eight . .	8	Forty-two .	42	Seventy-six	76
Nine . . .	9	Forty-three .	43	Seventy-seven	77
Ten . . .	10	Forty-four .	44	Seventy-eight	78
Eleven . .	11	Forty-five .	45	Seventy-nine	79
Twelve . .	12	Forty-six .	46	Eighty	80
Thirteen .	13	Forty-seven	47	Eighty-one	81
Fourteen .	14	Forty-eight	48	Eighty-two	82
Fifteen . .	15	Forty-nine	49	Eighty-three	83
Sixteen . .	16	Fifty . .	50	Eighty-four	84
Seventeen .	17	Fifty-one .	51	Eighty-five	85
Eighteen .	18	Fifty-two .	52	Eighty-six	86
Nineteen .	19	Fifty-three .	53	Eighty-seven	87
Twenty . .	20	Fifty-four .	54	Eighty-eight	88
Twenty-one	21	Fifty-five .	55	Eighty-nine	89
Twenty-two	22	Fifty-six .	56	Ninety	90
Twenty-three	23	Fifty-seven .	57	Ninety-one	91
Twenty-four	24	Fifty-eight .	58	Ninety-two	92
Twenty-five	25	Fifty-nine .	59	Ninety-three	93
Twenty-six	26	Sixty . .	60	Ninety-four	94
Twenty-seven	27	Sixty-one .	61	Ninety-five	95
Twenty-eight	28	Sixty-two .	62	Ninety-six	96
Twenty-nine	29	Sixty-three .	63	Ninety-seven	97
Thirty . .	30	Sixty-four .	64	Ninety-eight	98
Thirty-one .	31	Sixty-five .	65	Ninety-nine	99
Thirty-two .	32	Sixty-six .	66	One hundred	100
Thirty-three	33	Sixty-seven	67	Two hundred	200

LESSON IV.

Figures to be read.

1	45	79	59	26	14
5	16	97	96	40	43
7	39	81	53	82	67
19	93	18	71	80	83
27	63	72	22	88	10
29	30	28	23	37	62
36	78	100	32	20	61
99	48	89	52	94	96
17	84	98	85	91	25
21	51	54	58	74	70
87	15	65	31	13	68

What stands for twenty-one? What stands for twenty-five? What stands for thirty? What stands for thirty-seven? What stands for sixty-one? What stands for seventy-five? What stands for eighty-six? What stands for ninety-one? What stands for sixty-nine? What stands for twenty-eight? What stands for forty-one? What stands for fifty-six?

Write the following numbers, in figures, on the slate:—

Twenty-one. Twenty-six. Twenty-nine. Thirty-five. Sixty-seven. Ninety-eight. Six. Eighty-one. Eighty-seven. Eighty-nine. Forty-six. Fifty-seven. Fifty-nine. Sixty-four. One hundred. Seventy-five. Seventy. Sixty. Fifty. Ten. Twelve. Fourteen. Nineteen. Twenty. Twenty-six. Ninety-one.

LESSON V.

Roman Table.

I	One	XX .	Twenty
II . . .	Two	XXI .	Twenty-one
III . . .	Three	XXX .	Thirty
IV . . .	Four	XL .	Forty
V . . .	Five	L . .	Fifty
VI . . .	Six	LX .	Sixty
VII . . .	Seven	LXX .	Seventy
VIII . . .	Eight	LXXX	Eighty
IX . . .	Nine	XC .	Ninety
X	Ten	C . .	One hundred
XI . . .	Eleven	CC . .	Two hundred
XII . . .	Twelve	CCC .	Three hundred
XIII . . .	Thirteen	CCCC	Four hundred
XIV . . .	Fourteen	D . .	Five hundred
XV . . .	Fifteen	DC .	Six hundred
XVI . . .	Sixteen	DCC .	Seven hundred
XVII . .	Seventeen	DCCC	Eight hundred
XVIII . .	Eighteen	DCCCC	Nine hundred
XIX . . .	Nineteen	M . .	One thousand

This table is read, one I, one; two I's, two; three I's, three; IV, four, &c.

What stands for two? What stands for four? What stands for five? What stands for eight? What stands for ten? What stands for twenty? What stands for thirty? What stands for forty? What stands for fifty? What stands for sixty? What stands for seventy? What stands for eighty? What stands for ninety? What stands for one hundred? What stands for five hundred? What for one thousand?

REMARKS FOR THE TEACHER.

It is the leading feature of the method of instruction developed in this book, to teach the pupil to combine figures by the eye alone.

The common language must first be used to indicate the relation between the figures. After that relation becomes known, the figures themselves should suggest the combination. For example, after having taught the first ten combinations in the usual way, as 1 and 1 are two, 1 and 2 are 3, &c., let the table be written on the blackboard as below, in lesson first, and in each of the following lessons. Let the teacher then take a pointer, and point to the figures 1 and 1, and let the whole class answer 2. Let him then point to the figures 1 and 2, and let the class answer 3, and so on for the entire table.

The drill of the class should be continued until the combinations can be read by the eye. This reading will save the use of four words in each combination. Thus, instead of saying one and six are seven, the eye glances at 1 and 6, and seven is uttered immediately. This method of operating on numbers by the combined process of sight and thought, will train the mind to the most rapid and exact methods of computation. Each of the ten lessons should be taught in the same manner—and *thoroughly taught.*

LESSON I.

1 and 1 are 2	1 and 6 are 7
1 and 2 are 3	1 and 7 are 8
1 and 3 are 4	1 and 8 are 9
1 and 4 are 5	1 and 9 are 10
1 and 5 are 6	1 and 10 are 11

For the Eye.

1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1

LESSON II.

2 and 1 are 3	2 and 6 are 8
2 and 2 are 4	2 and 7 are 9
2 and 3 are 5	2 and 8 are 10
2 and 4 are 6	2 and 9 are 11
2 and 5 are 7	2 and 10 are 12

For the Eye.

1	2	3	4	5	6	7	8	9	10
2	2	2	2	2	2	2	2	2	2

LESSON III.

3 and 1 are 4	3 and 6 are 9
3 and 2 are 5	3 and 7 are 10
3 and 3 are 6	3 and 8 are 11
3 and 4 are 7	3 and 9 are 12
3 and 5 are 8	3 and 10 are 13

For the Eye.

1	2	3	4	5	6	7	8	9	10
3	3	3	3	3	3	3	3	3	3

LESSON IV.

4 and 1 are 5	4 and 6 are 10
4 and 2 are 6	4 and 7 are 11
4 and 3 are 7	4 and 8 are 12
4 and 4 are 8	4 and 9 are 13
4 and 5 are 9	4 and 10 are 14

For the Eye.

1	2	3	4	5	6	7	8	9	10
4	4	4	4	4	4	4	4	4	4

LESSON V.

5 and 1 are 6	5 and 6 are 11
5 and 2 are 7	5 and 7 are 12
5 and 3 are 8	5 and 8 are 13
5 and 4 are 9	5 and 9 are 14
5 and 5 are 10	5 and 10 are 15

For the Eye.

1	2	3	4	5	6	7	8	9	10
5	5	5	5	5	5	5	5	5	5

LESSON VI.

6 and 1 are 7	6 and 6 are 12
6 and 2 are 8	6 and 7 are 13
6 and 3 are 9	6 and 8 are 14
6 and 4 are 10	6 and 9 are 15
6 and 5 are 11	6 and 10 are 16

For the Eye.

1	2	3	4	5	6	7	8	9	10
6	6	6	6	6	6	6	6	6	6

LESSON VII.

7 and 1 are 8	7 and 6 are 13
7 and 2 are 9	7 and 7 are 14
7 and 3 are 10	7 and 8 are 15
7 and 4 are 11	7 and 9 are 16
7 and 5 are 12	7 and 10 are 17

For the Eye.

1	2	3	4	5	6	7	8	9	10
7	7	7	7	7	7	7	7	7	7

LESSON VIII.

8 and 1 are 9	8 and 6 are 14
8 and 2 are 10	8 and 7 are 15
8 and 3 are 11	8 and 8 are 16
8 and 4 are 12	8 and 9 are 17
8 and 5 are 13	8 and 10 are 18

For the Eye.

1	2	3	4	5	6	7	8	9	10
8	8	8	8	8	8	8	8	8	8

LESSON IX.

9 and 1 are 10	9 and 6 are 15
9 and 2 are 11	9 and 7 are 16
9 and 3 are 12	9 and 8 are 17
9 and 4 are 13	9 and 9 are 18
9 and 5 are 14	9 and 10 are 19

For the Eye.

1	2	3	4	5	6	7	8	9	10
9	9	9	9	9	9	9	9	9	9

LESSON X.

10 and 1 are 11	10 and 6 are 16
10 and 2 are 12	10 and 7 are 17
10 and 3 are 13	10 and 8 are 18
10 and 4 are 14	10 and 9 are 19
10 and 5 are 15	10 and 10 are 20

For the Eye.

1	2	3	4	5	6	7	8	9	10
10	10	10	10	10	10	10	10	10	10

LESSON XI.

1	2	3	0	2	3	2	1
1	2	3	2	1	1	2	3
1	2	3	3	3	2	3	1
1	2	3	0	2	3	2	3
1	2	3	2	1	1	3	0
1	2	3	3	3	2	2	1
1	2	3	1	0	3	3	0
1	2	3	2	3	1	2	2

REMARKS FOR THE TEACHER.

Having written the column of 1's on the blackboard, let the pupils add them when pointed, beginning with the lower figure. The column of 2's being written, let them also be added, the class repeating the words four, six, eight, ten, &c., and none others. Let the 3's and each of the following columns be added in the same manner. Let the same method be pursued through the entire tables of addition.

LESSON XII.

1	1	0	0	1	1	0	1
1	0	0	1	0	1	1	1
1	0	0	1	0	0	1	0
1	0	0	1	0	1	1	1
1	0	0	0	0	1	0	0
1	0	1	1	0	0	1	1
1	0	0	0	0	1	1	0
1	0	1	1	0	0	1	1
1	0	0	1	0	0	0	1
1	0	1	0	0	1	1	1
1	0	1	0	0	0	0	0
1	0	0	1	1	0	0	1

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XIII.

2	1	0	1	2	2	1	1
2	0	1	2	1	0	2	0
2	2	2	0	0	1	0	2
2	0	1	1	2	2	2	1
2	1	2	2	1	0	1	0
2	2	0	0	0	1	0	2
2	2	1	2	0	2	1	1
2	0	2	1	1	0	0	2
2	2	1	0	2	1	2	0
2	1	0	2	2	2	1	1
2	0	1	1	1	0	0	2
2	2	2	0	0	1	2	1

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XIV.

3	0	1	0	1	2	2	1
3	1	2	2	3	3	0	2
3	2	3	3	0	1	3	0
3	3	0	2	2	3	2	2
3	2	3	1	1	1	1	1
3	0	1	0	3	2	3	3
3	1	2	2	2	3	2	2
3	3	2	1	1	2	1	1
3	2	1	3	2	1	2	0
3	0	3	2	3	3	3	1
3	2	2	1	0	2	2	2
3	3	1	4	1	1	0	3

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XV.

4	1	2	3	1	3	4	1
4	2	3	2	0	2	1	2
4	3	1	1	2	1	2	3
4	4	4	4	0	4	0	4
4	1	2	1	4	0	1	1
4	0	3	2	3	2	2	2
4	3	1	4	2	1	0	3
4	4	4	0	1	3	4	4
4	0	2	3	1	4	3	3
4	2	0	0	2	2	2	2
4	3	1	3	1	1	1	1
4	0	3	2	4	1	3	2

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XVI.

5	4	1	4	0	1	0	1
5	3	3	5	1	2	2	2
5	1	5	3	2	3	1	3
5	2	4	0	3	4	3	4
5	5	0	1	4	5	4	5
5	0	5	2	5	4	5	0
5	2	0	3	3	2	0	2
5	5	5	0	2	0	1	0
5	0	4	2	0	1	0	1
5	3	3	3	1	2	2	4
5	2	4	4	2	3	3	3
5	2	5	0	0	2	1	2

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XVII.

6	5	6	6	5	1	2	3
6	6	4	3	4	2	6	2
6	5	6	0	3	0	4	1
6	6	4	1	6	6	3	0
6	5	0	4	4	4	0	4
6	6	6	5	5	3	2	3
6	5	4	3	1	2	4	0
6	6	0	0	0	0	5	4
6	5	6	1	2	1	6	5
6	0	4	2	1	3	0	6
6	5	0	1	3	2	4	4
6	0	6	6	0	4	3	3

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XVIII.

7	0	1	5	4	7	0	6
7	1	0	3	3	4	7	5
7	2	3	2	2	3	6	4
7	3	2	1	1	2	5	3
7	4	1	0	0	1	4	2
7	5	7	4	6	0	3	1
7	6	6	3	7	7	2	0
7	7	3	5	5	6	1	6
7	6	5	4	4	5	4	3
7	5	4	3	3	4	5	5
7	4	3	0	2	3	6	4
7	3	2	4	1	2	7	3

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XIX.

8	8	0	6	1	7	0	4
8	7	1	7	2	6	2	3
8	6	2	8	3	3	8	2
8	5	4	0	4	2	7	1
8	4	8	1	5	0	6	0
8	3	7	2	8	1	3	4
8	2	6	3	6	2	2	3
8	1	5	4	7	3	0	2
8	0	4	5	5	4	1	1
8	3	3	6	6	6	3	4
8	2	2	7	2	7	2	1
8	1	1	8	1	8	1	6

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XX.

9	9	0	1	7	5	4	6
9	8	4	2	6	4	3	7
9	7	9	9	3	5	2	8
9	6	1	8	4	3	6	9
9	5	2	4	5	2	7	4
9	4	3	5	8	1	0	5
9	3	4	4	7	4	1	6
9	2	9	3	6	6	2	7
9	1	5	2	2	7	0	0
9	0	6	0	0	8	8	8
9	9	7	7	1	9	7	3
9	8	8	4	3	7	4	7

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XXI.

10	10	0	7	6	5	3	5
10	9	0	6	7	4	2	2
10	8	1	4	4	3	1	1
10	7	2	2	1	2	0	3
10	6	3	1	2	1	3	6
10	5	4	3	0	0	8	7
10	4	5	4	3	1	4	0
10	3	6	0	2	2	9	8
10	2	7	3	1	3	0	4
10	1	8	2	0	0	4	3
10	0	9	1	4	4	5	2
10	0	0	0	3	2	6	1

Let the pupil be exercised in reading the figures in each column, until he can do it with facility and accuracy.

LESSON XXII.

10	10	10	10	10	10	10	10	10	10
1	2	3	4	5	6	7	8	9	10
11	11	11	11	11	11	11	11	11	11
1	2	3	4	5	6	7	8	9	10
12	12	12	12	12	12	12	12	12	12
1	2	3	4	5	6	7	8	9	10
13	13	13	13	13	13	13	13	13	13
1	2	3	4	5	6	7	8	9	10
14	14	14	14	14	14	14	14	14	14
1	2	3	4	5	6	7	8	9	10
15	15	15	15	15	15	15	15	15	15
1	2	3	4	5	6	7	8	9	10
16	16	16	16	16	16	16	16	16	16
1	2	3	4	5	6	7	8	9	10
17	17	17	17	17	17	17	17	17	17
1	2	3	4	5	6	7	8	9	10
18	18	18	18	18	18	18	18	18	18
1	2	3	4	5	6	7	8	9	10
19	19	19	19	19	19	19	19	19	19
1	2	3	4	5	6	7	8	9	10

LESSON XXIII.

20	20	20	20	20	20	20	20	20	20
1	2	3	4	5	6	7	8	9	10
21	21	21	21	21	21	21	21	21	21
1	2	3	4	5	6	7	8	9	10
22	22	22	22	22	22	22	22	22	22
1	2	3	4	5	6	7	8	9	10
23	23	23	23	23	23	23	23	23	23
1	2	3	4	5	6	7	8	9	10
24	24	24	24	24	24	24	24	24	24
1	2	3	4	5	6	7	8	9	10
25	25	25	25	25	25	25	25	25	25
1	2	3	4	5	6	7	8	9	10
26	26	26	26	26	26	26	26	26	26
1	2	3	4	5	6	7	8	9	10
27	27	27	27	27	27	27	27	27	27
1	2	3	4	5	6	7	8	9	10
28	28	28	28	28	28	28	28	28	28
1	2	3	4	5	6	7	8	9	10
29	29	29	29	29	29	29	29	29	29
1	2	3	4	5	6	7	8	9	10

LESSON XXIV.

30	30	30	30	30	30	30	30	30	30
1	2	3	4	5	6	7	8	9	10
31	31	31	31	31	31	31	31	31	31
1	2	3	4	5	6	7	8	9	10
32	32	32	32	32	32	32	32	32	32
1	2	3	4	5	6	7	8	9	10
33	33	33	33	33	33	33	33	33	33
1	2	3	4	5	6	7	8	9	10
34	34	34	34	34	34	34	34	34	34
1	2	3	4	5	6	7	8	9	10
35	35	35	35	35	35	35	35	35	35
1	2	3	4	5	6	7	8	9	10
36	36	36	36	36	36	36	36	36	36
1	2	3	4	5	6	7	8	9	10
37	37	37	37	37	37	37	37	37	37
1	2	3	4	5	6	7	8	9	10
38	38	38	38	38	38	38	38	38	38
1	2	3	4	5	6	7	8	9	10
39	39	39	39	39	39	39	39	39	39
1	2	3	4	5	6	7	8	9	10

LESSON XXV.

40	40	40	40	40	40	40	40	40	40
1	2	3	4	5	6	7	8	9	10
41	41	41	41	41	41	41	41	41	41
1	2	3	4	5	6	7	8	9	10
42	42	42	42	42	42	42	42	42	42
1	2	3	4	5	6	7	8	9	10
43	43	43	43	43	43	43	43	43	43
1	2	3	4	5	6	7	8	9	10
44	44	44	44	44	44	44	44	44	44
1	2	3	4	5	6	7	8	9	10
45	45	45	45	45	45	45	45	45	45
1	2	3	4	5	6	7	8	9	10
46	46	46	46	46	46	46	46	46	46
1	2	3	4	5	6	7	8	9	10
47	47	47	47	47	47	47	47	47	47
1	2	3	4	5	6	7	8	9	10
48	48	48	48	48	48	48	48	48	48
1	2	3	4	5	6	7	8	9	10
49	49	49	49	49	49	49	49	49	49
1	2	3	4	5	6	7	8	9	10

LESSON XXVI.

50	50	50	50	50	50	50	50	50	50
1	2	3	4	5	6	7	8	9	10
51	51	51	51	51	51	51	51	51	51
1	2	3	4	5	6	7	8	9	10
52	52	52	52	52	52	52	52	52	52
1	2	3	4	5	6	7	8	9	10
53	53	53	53	53	53	53	53	53	53
1	2	3	4	5	6	7	8	9	10
54	54	54	54	54	54	54	54	54	54
1	2	3	4	5	6	7	8	9	10
55	55	55	55	55	55	55	55	55	55
1	2	3	4	5	6	7	8	9	10
56	56	56	56	56	56	56	56	56	56
1	2	3	4	5	6	7	8	9	10
57	57	57	57	57	57	57	57	57	57
1	2	3	4	5	6	7	8	9	10
58	58	58	58	58	58	58	58	58	58
1	2	3	4	5	6	7	8	9	10
59	59	59	59	59	59	59	59	59	59
1	2	3	4	5	6	7	8	9	10

LESSON XXVII.

60	60	60	60	60	60	60	60	60	60
1	2	3	4	5	6	7	8	9	10
61	61	61	61	61	61	61	61	61	61
1	2	3	4	5	6	7	8	9	10
62	62	62	62	62	62	62	62	62	62
1	2	3	4	5	6	7	8	9	10
63	63	63	63	63	63	63	63	63	63
1	2	3	4	5	6	7	8	9	10
64	64	64	64	64	64	64	64	64	64
1	2	3	4	5	6	7	8	9	10
65	65	65	65	65	65	65	65	65	65
1	2	3	4	5	6	7	8	9	10
66	66	66	66	66	66	66	66	66	66
1	2	3	4	5	6	7	8	9	10
67	67	67	67	67	67	67	67	67	67
1	2	3	4	5	6	7	8	9	10
68	68	68	68	68	68	68	68	68	68
1	2	3	4	5	6	7	8	9	10
69	69	69	69	69	69	69	69	69	69
1	2	3	4	5	6	7	8	9	10

LESSON XXVIII.

70	70	70	70	70	70	70	70	70	70
1	2	3	4	5	6	7	8	9	10
71	71	71	71	71	71	71	71	71	71
1	2	3	4	5	6	7	8	9	10
72	72	72	72	72	72	72	72	72	72
1	2	3	4	5	6	7	8	9	10
73	73	73	73	73	73	73	73	73	73
1	2	3	4	5	6	7	8	9	10
74	74	74	74	74	74	74	74	74	74
1	2	3	4	5	6	7	8	9	10
75	75	75	75	75	75	75	75	75	75
1	2	3	4	5	6	7	8	9	10
76	76	76	76	76	76	76	76	76	76
1	2	3	4	5	6	7	8	9	10
77	77	77	77	77	77	77	77	77	77
1	2	3	4	5	6	7	8	9	10
78	78	78	78	78	78	78	78	78	78
1	2	3	4	5	6	7	8	9	10
79	79	79	79	79	79	79	79	79	79
1	2	3	4	5	6	7	8	9	10

LESSON XXIX.

80	80	80	80	80	80	80	80	80	80
1	2	3	4	5	6	7	8	9	10
81	81	81	81	81	81	81	81	81	81
1	2	3	4	5	6	7	8	9	10
82	82	82	82	82	82	82	82	82	82
1	2	3	4	5	6	7	8	9	10
83	83	83	83	83	83	83	83	83	83
1	2	3	4	5	6	7	8	9	10
84	84	84	84	84	84	84	84	84	84
1	2	3	4	5	6	7	8	9	10
85	85	85	85	85	85	85	85	85	85
1	2	3	4	5	6	7	8	9	10
86	86	86	86	86	86	86	86	86	86
1	2	3	4	5	6	7	8	9	10
87	87	87	87	87	87	87	87	87	87
1	2	3	4	5	6	7	8	9	10
88	88	88	88	88	88	88	88	88	88
1	2	3	4	5	6	7	8	9	10
89	89	89	89	89	89	89	89	89	89
1	2	3	4	5	6	7	8	9	10

LESSON XXX.

90	90	90	90	90	90	90	90	90	90
1	2	3	4	5	6	7	8	9	10
91	91	91	91	91	91	91	91	91	91
1	2	3	4	5	6	7	8	9	10
92	92	92	92	92	92	92	92	92	92
1	2	3	4	5	6	7	8	9	10
93	93	93	93	93	93	93	93	93	93
1	2	3	4	5	6	7	8	9	10
94	94	94	94	94	94	94	94	94	94
1	2	3	4	5	6	7	8	9	10
95	95	95	95	95	95	95	95	95	95
1	2	3	4	5	6	7	8	9	10
96	96	96	96	96	96	96	96	96	96
1	2	3	4	5	6	7	8	9	10
97	97	97	97	97	97	97	97	97	97
1	2	3	4	5	6	7	8	9	10
98	98	98	98	98	98	98	98	98	98
1	2	3	4	5	6	7	8	9	10
99	99	99	99	99	99	99	99	99	99
1	2	3	4	5	6	7	8	9	10

LESSON XXXI.

In this lesson let the pupil be first taught that a single thing is represented by 1; that 1 and a naught at the right represent a unit of the second order; 1 and two 0's, a unit of the third order; 1 and three 0's, a unit of the fourth order; 1 and four 0's, a unit of the fifth order; and so on for any number of places, according to the following table.

ORDERS OF UNITS.

A single unit, or unit of the first order, . .	1
A unit of the second order, ...	10
A unit of the third order, ...	100
A unit of the fourth order, ...	1000
A unit of the fifth order, ...	10000
A unit of the sixth order, ...	100000
A unit of the seventh order, . . .	1000000
A unit of the eighth order, . . .	10000000
A unit of the ninth order, . . .	100000000
&c. &c.	&c.

Let the pupil be now taught the relative value of these units; viz., that ten units of the first order make one of the second; ten of the second one of the third; ten of the third one of the fourth; and so on for all the values. Let the teacher put the questions: What is a unit? *Ans.* It is a single thing.—What is a unit of the second order? *Ans.* A single ten.—What is a unit of the third order? Of the fourth order? Of the fifth? &c.

LESSON XXXII.

Let the class now commit to memory the words at the head of the numeration table, and then be much practised in reading figures, both by the *orders of units*, and by the names at the head of the table.

NUMERATION TABLE.

Hundreds of Quadrillions.	Tens of Quadrillions.	Quadrillions.	Hundreds of Trillions.	Tens of Trillions.	Trillions.	Hundreds of Billions.	Tens of Billions.	Billions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
																	6,
																7	5,
															8	7	9,
														6,	0	2	3,
													8	2,	4	0	1,
												1	2	3,	0	8	7,
											7,	6	2	8,	7	3	5,
										4	3,	2	1	0,	4	6	0,
									5	4	8,	7	2	1,	0	8	7,
								6,	2	4	5,	2	8	9,	4	2	1,
							7	2,	5	4	9,	1	3	6,	8	2	2,
						8	9	4,	6	0	2,	0	4	3,	2	8	8,
					7,	6	4	1,	2	4	8,	9	0	7,	4	5	6,
				8	4,	9	1	2,	8	7	6,	4	1	0,	2	8	5,
			9	1	2,	7	6	1,	2	5	7,	3	2	7,	8	2	6,
		6,	4	0	7,	2	1	2,	9	3	6,	8	7	6,	5	4	1,
	5	7,	2	8	9,	6	7	8,	5	4	1,	2	9	7,	3	1	3,
9	2	0,	3	2	3,	8	4	2,	7	6	8,	3	1	9,	6	7	5,

1. What is Arithmetic?

Arithmetic is the science of Numbers.

2. How are numbers expressed in arithmetic?

Numbers are expressed by certain characters called figures.

3. How many figures are there? Ten. 4. Name them.

5. What is Notation?

Notation is the art of expressing numbers by figures.

6. What is Numeration?

Numeration is the art of reading figures correctly when written.

7. What is the sum of two or more numbers?

The sum of two or more numbers is a number which contains as many units as there are in the numbers added.

8. What is Addition?

Addition is the process of finding the sum of two or more numbers.

9. How many parts are there in addition? Three.

10. What are they?

1st. Setting down the numbers; 2d. Adding the columns; and 3d. Writing down the results.

11. How do you set down the numbers for addition?

Place units under units, tens under tens, hundreds under hundreds, &c.

12. How do you add up the columns?

Begin at the right hand, and add up each column in succession.

13. How do you write down the results?

Write the sum of any column less than ten under the column: when the sum is greater than ten, write the excess over exact tens, and carry to the next column, and write down the entire sum under the last column.

LESSON XXXIV.

(1)	(2)	(3)
10478	306721	1041321
19327	912784	2163419
67049	903670	9548374
45239	715048	7903456
39174	489350	6984387

(4)	(5)	(6)
104721	37041	2704127
999088	23074	2981672
488478	21679	8041428
369108	74127	8974120
437862	89435	4287049

LESSON XXXV.

(1)	(2)	(3)
874168	270402	3367041
812230	364172	2740821
904976	369041	6974812
104693	870523	4129047
412704	104712	6781214

(4)	(5)	(6)
812704	267204	9989742
223109	918236	3674214
902231	254181	9782495
678982	298149	4127628
497281	607089	7481497
369327	495262	9874162

LESSON XXXVI.

(1)	(2)	(3)
104324	204103	390410
212351	316042	210417
104512	413204	302814
453204	216305	213204
532140	412704	321604
214161	302604	330216
210432	403014	202524
203103	212103	210253
312042	320412	210497
130421	152041	324103
124104	410230	312101
512302	310210	305016

REMARK.—In these Lessons, let the pupil be taught how to set down and carry.

LESSON XXXVII.

(1)	(2)	(3)
120436	980416	216704
890912	823407	984167
979421	187214	210414
723610	694807	912631
270426	253641	104370
610312	872016	918070
304108	610432	416174
270416	708021	632146
332309	321089	218413
216704	270421	841262
370419	874106	213129
672041	210467	940026

LESSON XXXVIII.

(1)	(2)	(3)
1043621	10741632	10496787
4032141	48432704	27047021
1404021	21036214	87260421
2646021	21476390	99270492
4110421	27416532	70414210

LESSON XXXIX.

(1)	(2)
407306912	998704937
274372136	416402873
103702348	555555566
472132704	666666666
987023670	778888888
274033970	888877777
890320789	111111100
360497021	000043265
278264129	984278413
487264023	670418723

LESSON XL.

(1)	(2)
12245676901	14978478910
88467416712	99896949472
09124097021	21674127874
14974072146	37840258565
87497187261	05405040505
91895327027	89712754545
81923740989	67656575745
40732814756	95058585754
75872704161	45556578400
10076237041	04757585955

LESSON XLI.

(1)	(2)
107695624129	101497847867
121677446884	729989694938
219704012098	742167412767
467214097145	656704187230
618727149875	055940567806
272705389915	453825681998
894093792817	453586881017
561472873407	547678810930
610412787754	006817108241
413706207109	556161049607
475758505565	788754294878
459505858567	657137815492
657589712754	370287656120
805040544025	826404567023

LESSON XLII.

(1)	(2)
6913407302702	1216704980421
2274376912991	4984167108926
2103709714129	6210414802117
2472134972148	1912631904341
3987020271206	4104370980416
3274037449412	5918070823407
3890327408254	4416174187212
7360490040226	2632146694807
4278264248100	8218413253640
4487256141634	9841262800436
8710922327063	5213129329121
2146028362150	6940026272189
7247027763951	7210467097942
2014041516534	8741061723610

SUBTRACTION.

SUBTRACTION is to be taught in the same way as Addition, viz. first by indicating the difference between the numbers by means of the common language, and then the subtraction is to be made from inspection by the eye.

Thus, in the first lesson we teach the table in the common way, and then by the eye, and similarly for all the lessons which follow.

LESSON I.

1 from 1 and 0	1 from 6 and 5
1 from 2 and 1	1 from 7 and 6
1 from 3 and 2	1 from 8 and 7
1 from 4 and 3	1 from 9 and 8
1 from 5 and 4	1 from 10 and 9

For the Eye.

1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1

LESSON II.

2 from 2 and 0	2 from 7 and 5
2 from 3 and 1	2 from 8 and 6
2 from 4 and 2	2 from 9 and 7
2 from 5 and 3	2 from 10 and 8
2 from 6 and 4	2 from 11 and 9

For the Eye.

2	3	4	5	6	7	8	9	10	11
2	2	2	2	2	2	2	2	2	2

LESSON III.

3 from 3 and 0	3 from 8 and 5
3 from 4 and 1	3 from 9 and 6
3 from 5 and 2	3 from 10 and 7
3 from 6 and 3	3 from 11 and 8
3 from 7 and 4	3 from 12 and 9

For the Eye.

3	4	5	6	7	8	9	10	11	12
3	3	3	3	3	3	3	3	3	3

LESSON IV.

4 from 4 and 0	4 from 9 and 5
4 from 5 and 1	4 from 10 and 6
4 from 6 and 2	4 from 11 and 7
4 from 7 and 3	4 from 12 and 8
4 from 8 and 4	4 from 13 and 9

For the Eye.

4	5	6	7	8	9	10	11	12	13
4	4	4	4	4	4	4	4	4	4

LESSON V.

5 from 5 and 0	5 from 10 and 5
5 from 6 and 1	5 from 11 and 6
5 from 7 and 2	5 from 12 and 7
5 from 8 and 3	5 from 13 and 8
5 from 9 and 4	5 from 14 and 9

For the Eye.

5	6	7	8	9	10	11	12	13	14
5	5	5	5	5	5	5	5	5	5

LESSON VI.

6 from 6 and 0	6 from 11 and 5
6 from 7 and 1	6 from 12 and 6
6 from 8 and 2	6 from 13 and 7
6 from 9 and 3	6 from 14 and 8
6 from 10 and 4	6 from 15 and 9

For the Eye.

6	7	8	9	10	11	12	13	14	15
6	6	6	6	6	6	6	6	6	6

LESSON VII.

7 from 7 and 0	7 from 12 and 5
7 from 8 and 1	7 from 13 and 6
7 from 9 and 2	7 from 14 and 7
7 from 10 and 3	7 from 15 and 8
7 from 11 and 4	7 from 16 and 9

For the Eye.

7	8	9	10	11	12	13	14	15	16
7	7	7	7	7	7	7	7	7	7

LESSON VIII.

8 from 8 and 0	8 from 13 and 5
8 from 9 and 1	8 from 14 and 6
8 from 10 and 2	8 from 15 and 7
8 from 11 and 3	8 from 16 and 8
8 from 12 and 4	8 from 17 and 9

For the Eye.

8	9	10	11	12	13	14	15	16	17
8	8	8	8	8	8	8	8	8	8

LESSON IX.

9 from 9 and 0	9 from 14 and 5
9 from 10 and 1	9 from 15 and 6
9 from 11 and 2	9 from 16 and 7
9 from 12 and 3	9 from 17 and 8
9 from 13 and 4	9 from 18 and 9

For the Eye.

9	10	11	12	13	14	15	16	17	18
9	9	9	9	9	9	9	9	9	9

LESSON X.

We see, from the above examples, that when the lower figure is less than the one directly over it, we may suppose ten to be added to the upper figure.

If several figures are written by the side of each other, thus—

From	648321
Take	3746
	644575

we say, 6 from 11 leaves 5; then we add 1 to the next figure to the left and say, 5 from 12 leaves 7: we then add 1 to the 7 and say, 8 from 13 leaves 5: we then add 1 to the 3 and say, 4 from 8 leaves 4. We then bring down the figures 4 and 6, and find the result to be 644575.

	(1)	(2)	(3)
From	840704	9200762	6191804
Take	71230	4618127	4923709

LESSON XI.

	(1)	(2)	(3)
From	284104	180467	1049761
Take	37093	67092	42167

	(4)	(5)	(6)
From	4967842	2841049	27084874
Take	270482	67814	3727041

	(7)	(8)	(9)
From	84276704	9670912	3607401
Take	7284093	284267	1674198

	(10)	(11)	(12)
From	10972876	91284167	41270412
Take	10897049	80496701	27849555

	(13)	(14)	(15)
From	87412607	670496	3270416
Take	2780416	284155	3030219

	(16)	(17)	(18)
From	67492704	9541098	2741695
Take	24926704	1098755	1270416

	(19)	(20)	(21)
From	8417041	2708416	72840509
Take	2781216	1942704	53047041

	(22)	(23)	(24)
From	81416704	91081210	6784104
Take	27041709	2837949	5550999

LESSON XII.

Questions in Subtraction.

1. What is Subtraction?

Subtraction is the process of finding the difference between two numbers.

2. If the numbers are unequal, what is the larger called?

The minuend.

3. What is the less number called?

The subtrahend.

4. What is the difference called?

The remainder.

5. How are the numbers written down for subtraction?

The less number is written under the greater, so that units shall stand under units, tens under tens, hundreds under hundreds, &c.

6. How do you make the subtraction?

Begin at the right hand, and subtract each figure of the subtrahend from the one directly over it. But if the upper figure is the least, add ten to it, and then make the subtraction, and add one to the next left-hand figure of the subtrahend.

7. If the minuend and subtrahend are equal, which is written above?

Either may then be written in the upper place.

8. What will then be the difference?

Their difference will then be 0.

MULTIPLICATION.

The multiplication table is to be learned by the eye, in the same manner as the tables of addition and subtraction; that is, let the teacher point to the two figures that are to be multiplied together, and require the pupil to pronounce the result.

LESSON I.

Once	1	is	1		Once	7	is	7
Once	2	is	2		Once	8	is	8
Once	3	is	3		Once	9	is	9
Once	4	is	4		Once	10	is	10
Once	5	is	5		Once	11	is	11
Once	6	is	6		Once	12	is	12

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
1	1	1	1	1	1	1	1	1	1	1	1

LESSON II.

2	times	1	are	2		2	times	7	are 14
2	times	2	are	4		2	times	8	are 16
2	times	3	are	6		2	times	9	are 18
2	times	4	are	8		2	times	10	are 20
2	times	5	are	10		2	times	11	are 22
2	times	6	are	12		2	times	12	are 24

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
2	2	2	2	2	2	2	2	2	2	2	2

LESSON III.

3 times 1 are 3	3 times 7 are 21
3 times 2 are 6	3 times 8 are 24
3 times 3 are 9	3 times 9 are 27
3 times 4 are 12	3 times 10 are 30
3 times 5 are 15	3 times 11 are 33
3 times 6 are 18	3 times 12 are 36

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
3	3	3	3	3	3	3	3	3	3	3	3

LESSON IV.

4 times 1 are 4	4 times 7 are 28
4 times 2 are 8	4 times 8 are 32
4 times 3 are 12	4 times 9 are 36
4 times 4 are 16	4 times 10 are 40
4 times 5 are 20	4 times 11 are 44
4 times 6 are 24	4 times 12 are 48

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
4	4	4	4	4	4	4	4	4	4	4	4

LESSON V.

5 times 1 are 5	5 times 7 are 35
5 times 2 are 10	5 times 8 are 40
5 times 3 are 15	5 times 9 are 45
5 times 4 are 20	5 times 10 are 50
5 times 5 are 25	5 times 11 are 55
5 times 6 are 30	5 times 12 are 60

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
5	5	5	5	5	5	5	5	5	5	5	5

LESSON VI.

6 times 1 are 6	6 times 7 are 42
6 times 2 are 12	6 times 8 are 48
6 times 3 are 18	6 times 9 are 54
6 times 4 are 24	6 times 10 are 60
6 times 5 are 30	6 times 11 are 66
6 times 6 are 36	6 times 12 are 72

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
6	6	6	6	6	6	6	6	6	6	6	6

LESSON VII.

7 times 1 are 7	7 times 7 are 49
7 times 2 are 14	7 times 8 are 56
7 times 3 are 21	7 times 9 are 63
7 times 4 are 28	7 times 10 are 70
7 times 5 are 35	7 times 11 are 77
7 times 6 are 42	7 times 12 are 84

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
7	7	7	7	7	7	7	7	7	7	7	7

LESSON VIII.

8 times 1 are 8	8 times 7 are 56
8 times 2 are 16	8 times 8 are 64
8 times 3 are 24	8 times 9 are 72
8 times 4 are 32	8 times 10 are 80
8 times 5 are 40	8 times 11 are 88
8 times 6 are 48	8 times 12 are 96

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
8	8	8	8	8	8	8	8	8	8	8	8

LESSON IX.

9 times 1 are 9	9 times 7 are 63
9 times 2 are 18	9 times 8 are 72
9 times 3 are 27	9 times 9 are 81
9 times 4 are 36	9 times 10 are 90
9 times 5 are 45	9 times 11 are 99
9 times 6 are 54	9 times 12 are 108

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
9	9	9	9	9	9	9	9	9	9	9	9

LESSON X.

10 times 1 are 10	10 times 7 are 70
10 times 2 are 20	10 times 8 are 80
10 times 3 are 30	10 times 9 are 90
10 times 4 are 40	10 times 10 are 100
10 times 5 are 50	10 times 11 are 110
10 times 6 are 60	10 times 12 are 120

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
10	10	10	10	10	10	10	10	10	10	10	10

LESSON XI.

11 times 1 are 11	11 times 7 are 77
11 times 2 are 22	11 times 8 are 88
11 times 3 are 33	11 times 9 are 99
11 times 4 are 44	11 times 10 are 110
11 times 5 are 55	11 times 11 are 121
11 times 6 are 66	11 times 12 are 132

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
11	11	11	11	11	11	11	11	11	11	11	11

LESSON XII.

12 times 1 are 12	12 times 7 are 84
12 times 2 are 24	12 times 8 are 96
12 times 3 are 36	12 times 9 are 108
12 times 4 are 48	12 times 10 are 120
12 times 5 are 60	12 times 11 are 132
12 times 6 are 72	12 times 12 are 144

For the Eye.

12	11	10	9	8	7	6	5	4	3	2	1
12	12	12	12	12	12	12	12	12	12	12	12

LESSON XIII.

1. What is Multiplication?

Multiplication is the process of taking one number as many times as there are units in another.

2. What is the number to be taken called?

The multiplicand.

3. What is the number called which denotes how many times the multiplicand is to be taken?

The multiplier.

4. What are the multiplier and multiplicand taken together called?

The factors; or simply, factors.

5. What is the result of the multiplication called?

The product.

6. If the multiplier is 1, what will the product be?

The same as the multiplicand.

LESSON XIV.

Examples in Multiplication.

In each of the following examples the pupil should be taught to pronounce the result immediately, without using or repeating any of the intermediate words.

(1)	(2)	(3)
1203123	1232012	12012210
2	3	4
(4)	(5)	(6)
12340421	14130621	254012641
5	6	7
(7)	(8)	(9)
410421302	412604321	270412062
6	7	8
(10)	(11)	(12)
87046704	670412704	412672048
9	8	7
(13)	(14)	(15)
4974051	72041261	4127041236
10	11	12
(16)	(17)	(18)
87534564	38976435	538705689
9	10	8

LESSON XV.

(1)	(2)	(3)
91841067	3704126701	412704262
4	5	6
(4)	(5)	(6)
270412704	312704167	214267041
7	6	5
(7)	(8)	(9)
6784141304	908704162	41270416704
4	5	6
(10)	(11)	(12)
21416784104	3672412741	4927046426
7	6	7
(13)	(14)	(15)
896704972	416787416	7769412746
10	11	12
(16)	(17)	(18)
814627049	69598769	9181719987
12	11	9
(19)	(20)	(21)
6520926741	814127876	91894762
8	7	12
(22)	(23)	(24)
9546783258	6877432543	85635427
12	10	11

LESSON XVI.

When the multiplier is greater than 12, multiply by each of the figures in succession, and then add up the several results.

(1)	(2)	(3)
3678432	27416741	2149302146
24	36	34

(4)	(5)	(6)
6121412045	69411418	274167041
172	1041	27042

(7)	(8)	(9)
214261718	21418416	314227421
40216	5908	67096

(10)	(11)	(12)
270417281	918741270	814267418
61287	19872	69078

(13)	(14)	(15)
284269874	98497216	88724160
9627	82467	26089

(16)	(17)	(18)
91874609	91817269	98270426
32046	8491	91874

DIVISION.

The division table is to be learned by the eye, the same as the tables which precede. Thus, in Lesson II., the teacher is to point to 2, 4, 6, 8, 10, &c., in succession, and the pupil is to answer, 1, 2, 3, 4, 5, &c., and the same for the succeeding lessons.

LESSON I.

1 in	1	once	1 in	7	seven times
1 in	2	two times	1 in	8	eight times
1 in	3	three times	1 in	9	nine times
1 in	4	four times	1 in	10	ten times
1 in	5	five times	1 in	11	eleven times
1 in	6	six times	1 in	12	twelve times.

For the Eye.

1)1 2 3 4 5 6 7 8 9 10 11 12

LESSON II.

2 in	2	once	2 in	14	seven times
2 in	4	two times	2 in	16	eight times
2 in	6	three times	2 in	18	nine times
2 in	8	four times	2 in	20	ten times
2 in	10	five times	2 in	22	eleven times
2 in	12	six times	2 in	24	twelve times.

For the Eye.

2)2 4 6 8 10 12 14 16 18 20 22 24

LESSON III.

3 in 3 once	3 in 21 seven times
3 in 6 two times	3 in 24 eight times
3 in 9 three times	3 in 27 nine times
3 in 12 four times	3 in 30 ten times
3 in 15 five times	3 in 33 eleven times
3 in 18 six times	3 in 36 twelve times.

For the Eye.

3)3 6 9 12 15 18 21 24 27 30 33 36

LESSON IV.

4 in 4 once	4 in 28 seven times
4 in 8 two times	4 in 32 eight times
4 in 12 three times	4 in 36 nine times
4 in 16 four times	4 in 40 ten times
4 in 20 five times	4 in 44 eleven times
4 in 24 six times	4 in 48 twelve times.

For the Eye.

4)4 8 12 16 20 24 28 32 36 40 44 48

LESSON V.

5 in 5 once	5 in 35 seven times
5 in 10 two times	5 in 40 eight times
5 in 15 three times	5 in 45 nine times
5 in 20 four times	5 in 50 ten times
5 in 25 five times	5 in 55 eleven times
5 in 30 six times	5 in 60 twelve times.

For the Eye.

5)5 10 15 20 25 30 35 40 45 50 55 60

LESSON VI.

6 in 6 once	6 in 42 seven times
6 in 12 two times	6 in 48 eight times
6 in 18 three times	6 in 54 nine times
6 in 24 four times	6 in 60 ten times
6 in 30 five times	6 in 66 eleven times
6 in 36 six times	6 in 72 twelve times.

For the Eye.

6)6 12 18 24 30 36 42 48 54 60 66 72

LESSON VII.

7 in 7 once	7 in 49 seven times
7 in 14 two times	7 in 56 eight times
7 in 21 three times	7 in 63 nine times
7 in 28 four times	7 in 70 ten times
7 in 35 five times	7 in 77 eleven times
7 in 42 six times	7 in 84 twelve times.

For the Eye.

7)7 14 21 28 35 42 49 56 63 70 77 84

LESSON VIII.

8 in 8 once	8 in 56 seven times
8 in 16 two times	8 in 64 eight times
8 in 24 three times	8 in 72 nine times
8 in 32 four times	8 in 80 ten times
8 in 40 five times	8 in 88 eleven times
8 in 48 six times	8 in 96 twelve times.

For the Eye.

8)8 16 24 32 40 48 56 64 72 80 88 96

LESSON IX.

9 in 9	once		9 in 63	seven times	
9 in 18	two times		9 in 72	eight times	
9 in 27	three times		9 in 81	nine times	
9 in 36	four times		9 in 90	ten times	
9 in 45	five times		9 in 99	eleven times	
9 in 54	six times		9 in 108	twelve times.	

For the Eye.

9)9 18 27 36 45 54 63 72 81 90 99 108

LESSON X.

10 in 10	once		10 in 70	seven times	
10 in 20	two times		10 in 80	eight times	
10 in 30	three times		10 in 90	nine times	
10 in 40	four times		10 in 100	ten times	
10 in 50	five times		10 in 110	eleven times	
10 in 60	six times		10 in 120	twelve times.	

For the Eye.

10)10 20 30 40 50 60 70 80 90 100 110 120

LESSON XI.

11 in 11	once		11 in 77	seven times	
11 in 22	two times		11 in 88	eight times	
11 in 33	three times		11 in 99	nine times	
11 in 44	four times		11 in 110	ten times	
11 in 55	five times		11 in 121	eleven times	
11 in 66	six times		11 in 132	twelve times.	

For the Eye.

11)11 22 33 44 55 66 77 88 99 110 121 132

LESSON XII.

12 in 12	once	12 in 84	seven times
12 in 24	two times	12 in 96	eight times
12 in 36	three times	12 in 108	nine times
12 in 48	four times	12 in 120	ten times
12 in 60	five times	12 in 132	eleven times
12 in 72	six times	12 in 144	twelve times

For the Eye.

12)12 24 36 48 60 72 84 96 108 120 132 144

LESSON XIII.

1. What is Division?

Division is a short process of finding how many times one number contains another.

2. What is the number by which you divide called?

The divisor.

3. What is the number divided called?

The dividend.

4. What is the result called?

The quotient.

5. If the dividend does not contain the divisor an exact number of times, what is the number which is left called?

The remainder.

6. What is short division?

It is division in which the divisor does not exceed 12.

7. If the dividend and divisor are equal, what will the quotient be?

One, or a simple unit.

LESSON XIV.

(1) 2)60444	(2) 2)7456728	(3) 3)1450506
(4) 3)48740362	(5) 4)8006300	(6) 6)4104702
(7) 7)84567042	(8) 8)81926704	(9) 9)906471
(10) 2)41670426	(11) 3)69984672	(12) 4)415285696
(13) 5)847523160	(14) 5)813067120	(15) 5)690497260
(16) 6)908704206	(17) 7)17041927	(18) 8)49672704
(19) 5)754926120	(20) 6)888888	(21) 7)999999
(22) 9)197046	(23) 10)4087460	(24) 11)227896416
(25) 12)884167416	(26) 12)4020300	(27) 11)44962060
(28) 9)810416115	(29) 8)7704664	(30) 11)91204619

LESSON XV.

(1) 3)65740	(2) 5)9495782	(3) 4)9154506
(4) 6)24863740	(5) 3)7863070	(6) 7)7041024
(7) 2)56704284	(8) 8)81926704	(9) 9)906471
(10) 9)54167054	(11) 3)76984679	(12) 4)341528536
(13) 7)680475231	(14) 7)718903062	(15) 5)626904709
(16) 9)1970469	(17) 10)4087460	(18) 11)522785964
(19) 5)754902612	(20) 5)869752	(21) 7)989979
(22) 6)980703486	(23) 5)71270419	(24) 8)57496727
(25) 8)810416115	(26) 9)7504964	(27) 10)89192046
(28) 12)988416774	(29) 10)5402503	(30) 11)39620670

OF FRACTIONS AND THEIR READING.

LESSON I.

1 What is a unit?

A unit is any thing regarded as a whole.

2. By what figure is a simple unit expressed?

A simple unit is expressed by the figure 1.

3. If a unit be divided into any number of equal parts, what are these parts called?

If a unit be divided into any number of equal parts, the parts are called fractions.

4. How can these parts be expressed by figures?

These equal parts of unity may be expressed by figures, by writing the figures over each other with a line between them: thus, $\frac{3}{4}$.

5. What is the upper figure called?

The upper figure is called the numerator.

6. What is the lower figure called?

The lower figure is called the denominator.

7. What does the denominator show?

The denominator shows into how many equal parts the unit has been divided.

8. What does the numerator express?

The numerator expresses how many parts are taken.

Let the pupil now be taught to read the following fractions:—

$\frac{3}{4}$	three fourths.	$\frac{9}{10}$	nine tenths.
$\frac{7}{8}$	seven eighths.	$\frac{15}{2}$	fifteen halves.
$\frac{9}{16}$	nine sixteenths.	$\frac{9}{12}$	nine twelfths.
$\frac{8}{11}$	eight elevenths.	$\frac{14}{15}$	fourteen fifteenths.
$\frac{5}{4}$	five fourths.	$\frac{12}{19}$	twelve nineteenths.
$\frac{6}{7}$	six sevenths.	$\frac{9}{13}$	nine thirteenths.

9. When the unit is divided into any number of equal parts, what are the fractions called?

When the unit is divided into any number of equal parts, the fractions are called Common or Vulgar Fractions.

LESSON II.

Of reading Decimals.

1. If a unit be divided into ten equal parts, what is each part called?

If a unit be divided into ten equal parts, each part is called a tenth.

2. How may such parts of unity be expressed?

By simply placing a period before the figure which expresses the number of parts. Thus,

.1	expresses		one tenth,
.2	-	-	two tenths,
.3	-	-	three tenths,
4	-	-	four tenths,
.5	-	-	five tenths,
.6	-	-	six tenths,
.7	-	-	seven tenths,
.8	-	-	eight tenths,
.9	-	-	nine tenths.

3. If each of these tenths be again divided into ten equal parts, what will be the value of each part so obtained?

If each tenth be again divided into ten equal parts, each part, after the division, will be one hundredth.

4. How may these hundredths be expressed by figures?

These hundredth parts may be expressed by figures, by placing them on the right of the tenths. Thus,

.14	expresses	1	tenth	and	4	hundredths,
.28	- -	2	tenths	and	8	hundredths,
.09	- -	0	tenths	and	9	hundredths,
.47	- -	4	tenths	and	7	hundredths,
.78	- -	7	tenths	and	8	hundredths.

5. When the unit is divided according to the scale of tens, what are the fractions called?

When the unit is divided according to the scale of tens, the fractions are called Decimal Fractions.

DECIMAL NUMERATION TABLE.

Tenths.	Hundredths.	Thousandths.	Tens of Thousandths.	Hundreds of Thousandths.	Millionths.	Tens of Millionths.	Hundreds of Millionths.	Billionths.	Tens of Billionths.	Hundreds of Billionths.
.3										
.3	5									
.3	5	7	0	4						
.3	5	7	0	4	6	7	5			
.3	5	7	0	4	6	7	5	5	2	7

1. How many places are there in the first period of decimals?

There are but two.

2. Name them.

3. How many in each of the other periods?

4. What is the fractional unit of the first place?

One tenth.

5. What is the fractional unit of the second place?

One hundredth.

6. What is the fractional unit of the third place?

One thousandth.

Let the pupil explain in the same manner the unit of each place of the decimal numeration table, and then the unit of each place, and the readings of the following examples.

(1)	(2)	(3)
.0467067	.04704126	.94704628
(4)	(5)	(6)
.04967521	.9740218	.9427204264
(7)	(8)	(9)
970.412269378	41278.910467	67214.0047692
(10)	(11)	(12)
4172.0897167	3704.0967284	6970.8127673
(13)	(14)	(15)
28426.98745	5.984972165	887.241609

OF DENOMINATE NUMBERS.

LESSON I.

1. What are simple numbers?

Simple numbers express a collection of units of the same kind, without expressing the particular value of the unit.

2. What is a denominate number?

A denominate number expresses the kind of unit which is considered.

3. Give an example of a denominate number.

Six dollars is a denominate number, in which the unit is 1 dollar.

4. What is the unit of 4 yards of cloth? Is this a denominate or simple number?

LESSON II.

Federal Money.

1. What is the currency of the United States?

Federal money is the currency of the United States.

2. What are its denominations?

Its denominations, or names, are Eagles, Dollars, Dimes, Cents, and Mills.

3. Of what are the coins of the United States made?

The coins of the United States are of gold, silver, and copper.

4. Which are gold?

The eagle, half-eagle, and quarter-eagle.

5. Which are silver?

The dollar, half-dollar, quarter-dollar, dime, and half-dime.

6. Which are copper?

The cent and half-cent.

7. Repeat the table.

TABLE.

10 mills, marked *m.*	make	1 cent, marked	*ct.*
10 cents - - - - - -		1 dime, - -	*d.*
10 dimes - - - - - -		1 dollar, - -	$.
10 dollars - - - - - -		1 eagle, - -	*E.*

8. How are the parts of a dollar sometimes expressed?

The parts of a dollar are sometimes expressed fractionally, as in the following table:—

$1	= 100 cents,	$\frac{1}{8}$ of a doll.	= $12\frac{1}{2}$ cents,
$\frac{1}{2}$ of a dollar	= 50 cents,	$\frac{1}{10}$ of a doll.	= 10 cents,
$\frac{1}{3}$ of a dollar	= $33\frac{1}{3}$ cents,	$\frac{1}{16}$ of a doll.	= $6\frac{1}{4}$ cents,
$\frac{1}{4}$ of a dollar	= 25 cents,	$\frac{1}{20}$ of a doll.	= 5 cents.
$\frac{1}{5}$ of a dollar	= 20 cents,	$\frac{1}{2}$ of a cent	= 5 mills.

LESSON III.

English Money.

1. What are the denominations of English money?

The denominations of English money are guineas, pounds, shillings, pence, and farthings.

2. Repeat the table.

TABLE.

4 farthings, *far.*	make	1 penny, marked	*d.*
12 pence - - - - - -		1 shilling, - -	*s.*
20 shillings - - - - -		1 pound, - -	£.
21 shillings - - - - -		1 guinea.	

LESSON IV.

Avoirdupois Weight.

1. What is the standard avoirdupois pound of the United States?

The standard avoirdupois pound of the United States, as determined by Mr. Hassler, is the weight of 27.7015 cubic inches of distilled water.

2. For what is this weight used?

By this weight are weighed all coarse articles, such as hay, grain, chandlers' wares, and all the metals, except gold and silver.

3. What is the meaning of the terms *gross* and *net?*

Gross weight is the weight of the goods, with the boxes, casks, or bags in which they are contained. Net is the weight of the goods only; or what remains after deducting from the gross weight the weight of the boxes, casks, or bags.

4. What is a hundred weight?

According to the old method of weighing, which was adopted from the English system, 112 pounds make what was called one hundred weight.

5. How are goods now generally bought and sold?

At the present time, the merchants in our principal cities buy and sell by the 100 pounds.

6. How is the table to be read?

TABLE.

16 drams,	*dr.*	make 1 ounce,	marked	*oz.*
16 ounces - - -		1 pound, - - -		*lb.*
25 pounds - - -		1 quarter, - - -		*qr.*
4 quarters - - -		1 hundred weight,		*cwt.*
20 hundred weight,		1 ton, - - - -		*T.*

LESSON V.

Troy Weight.

1. What things are weighed by Troy weight?

Gold, silver, jewels, and liquors, are weighed by this weight.

2. What is the standard pound?

The standard Troy pound of the United States, as determined by Mr. Hassler, is the weight of 22.794377 cubic inches of distilled water. Hence, it is less than the pound avoirdupois.

3. What are its denominations?

Its denominations are pounds, ounces, pennyweights, and grains.

4. Repeat the table.

TABLE.

24 grains, *gr.*	make	1 pennyweight, marked	*pwt.*
20 pennyweights -		1 ounce, - - - -	*oz.*
12 ounces - - -		1 pound, - - - - -	*lb.*

LESSON VI.

Apothecaries' Weight.

1. What is the use of the Apothecaries' weight?

This weight is used by apothecaries and physicians in mixing their medicines.

2. What are its denominations?

Its denominations are pounds, ounces, drams, scruples, and grains.

3. Of what value are the pound and the ounce?

The pound and ounce are the same as the pound and ounce in the Troy weight; the difference be-

tween the two weights consists in the different divisions and subdivisions of the ounce.

4. Repeat the table.

TABLE.

20 grains, *gr.*	make	1 scruple,	marked	℈.
3 scruples - - -		1 dram,	- - -	ʒ.
8 drams - - -		1 ounce,	- - -	℥.
12 ounces - - -		1 pound,	- - -	℔.

LESSON VII.

Long Measure.

1. When is Long Measure used?

This measure is used to measure distances, lengths, breadths, heights, depths, &c.

2. What are its denominations?

Its denominations are barleycorns, inches, feet, yards, fathoms, rods, furlongs, and miles.

3. Repeat the table.

TABLE.

3 barleycorns, *bar.*	make	1 inch,	marked	*in.*
12 inches - - - - - -		1 foot, - - - - -		*ft.*
3 feet - - - - - - -		1 yard, - - - - -		*yd.*
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet - -		1 rod, perch, or pole,		*rd.*
40 rods - - - - - - -		1 furlong, - - - -		*fur.*
8 furlongs, or 320 rods -		1 mile, - - - - -		*mi.*
3 miles - - - - - - -		1 league, - - - -		*L.*
60 geographical or $69\frac{1}{2}$ statute miles -		1 degree, - -		*deg.* or °
360 degrees - - - - -		a great circle, or circumference of the earth.		

4. What is a fathom?

A fathom is a length of six feet, and is generally used to measure the depth of water.

5. What is a hand?

A hand is four inches, and is used to measure the height of horses.

LESSON VIII.

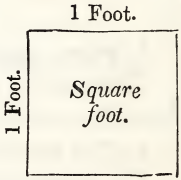
Land or Square Measure.

1. For what is Square Measure used?

Land or square measure is used in measuring land, or any thing in which length and breadth are both considered.

2. What is a square?

A square is the space included between four equal lines, drawn perpendicular to each other. Each line is called a side of the square.



3. If each side be one foot, what is it called?

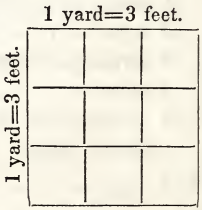
If each side be one foot, the figure is called a *square foot.*

4. If each side be a yard, what is it called?

If the sides of the square be each one yard, the square is called a *square yard.*

5. How many square feet does the square yard contain?

In the large square there are nine small squares, the sides of which are each one foot. Therefore the square yard contains 9 square feet.



6. How is the number of small squares contained in a large square found?

The number of small squares that is contained in

any large square is always equal to the product of two of the sides of the large square. As in the figure, $3 \times 3 = 9$ square feet. The number of square inches contained in a square foot is equal to $12 \times 12 = 144$.

7. Repeat the table.

TABLE.

144	square inches, *sq. in.*	make	1	square foot,	*Sq. ft.*
9	square feet - - - - - -		1	square yard,	*Sq. yd.*
$30\frac{1}{4}$	square yards - - - - - -		1	square pole, -	*P.*
40	square poles - - - - - -		1	rood, - - -	*R.*
4	roods - - - - - - - -		1	acre, - - -	*A.*
640	acres - - - - - - - -		1	square mile, -	*M.*

8. What chain is used in surveying land?

The surveyor's or Gunter's chain is generally used in surveying land.

9. How long is it?

It is 4 poles or 66 feet in length.

10. How is it divided?

It is divided into 100 links.

11. Repeat the table.

TABLE.

$7\frac{92}{100}$	inches	make	1	link, marked	*l.*
4	rods or 66*ft.* - -		1	chain, - - -	*c.*
80	chains - - -		1	mile, - - -	*mi.*
1	square chain - -		16	square poles, -	*P.*
10	square chains -		1	acre, - - -	*A.*

12. How is land generally estimated?

Land is generally estimated in square miles, acres, roods, and square poles or perches.

LESSON IX.

Solid or Cubic Measure.

1. For what is Solid or Cubic Measure used?

Solid or cubic measure is used in measuring stone, timber, earth, and such other things as have three dimensions, length, breadth, and thickness.

2. What are its denominations?

Its denominations are tons, cords, yards, feet, and inches.

3. Repeat the table.

TABLE.

1728 solid inches, *S. in.*	make 1 solid foot,	*S. ft.*
27 solid feet - - - - -	1 solid yard,	*S. yd.*
40 feet of round, or 50 feet of hewn timber, - - -	1 ton, - -	*Ton*
128 solid feet $= 8 \times 4 \times 4$, that is, a pile 8 feet in length, 4 feet in width, and 4 feet in height,	1 cord of wood, -	*C.*

4. What is a cord foot?

A cord foot is one foot in length of the pile which makes a cord.

5. How many solid feet does it contain?

It contains sixteen solid feet.

LESSON X.

Cloth Measure.

1. For what is Cloth Measure used?

Cloth measure is used for measuring all kinds of cloth.

2. What are its denominations?

Its denominations are Ells French, Ells English, Ells Flemish, yards, quarters, nails, and inches.

3. Repeat the table.

TABLE.

$2\frac{1}{4}$ inches, *in.*	make	1	nail,	marked	*na.*
4 nails - - - -		1	quarter of a yard,		*qr.*
4 quarters - - -		1	yard, - - -		*yd.*
3 quarters - - -		1	Ell Flemish,		*E. Fl.*
5 quarters - - -		1	Ell English,		*E. E.*
6 quarters - - -		1	Ell French,		*E. Fr.*

LESSON XI.

Liquid Measure.

1. What is measured by Liquid Measure?

The standard gallon of the United States is the wine gallon of Great Britain, and contains 231 cubic inches. This is the standard for all liquids.

2. What are its denominations?

The denominations of liquid measure are tuns, pipes, hogsheads, barrels, gallons, quarts, pints, and gills.

3. Repeat the table.

TABLE.

4 gills, *gi.*	make	1	pint,	marked	*pt.*
2 pints - - - -		1	quart, - -		*qt.*
4 quarts - - - -		1	gallon, - -		*gal.*
$31\frac{1}{2}$ gallons - - - -		1	barrel, - -		*bar.*
63 gallons - - - -		1	hogshead, -		*hhd.*
2 hogsheads - - -		1	pipe, - - -		*pi.*
2 pipes or 4 hogsheads		1	tun, - - -		*tun.*

LESSON XII.

Ale or Beer Measure.

1. What are the denominations of Ale or Beer Measure?

Its denominations are hogsheads, barrels, gallons, quarts, and pints.

2. Repeat the table.

TABLE.

2	pints, *pt.*	make	1	quart,	marked	*qt.*
4	quarts - - -		1	gallon,	- -	*gal.*
36	gallons - - -		1	barrel,	- - -	*bar.*
54	gallons - - -		1	hogshead,	- -	*hhd.*

LESSON XIII.

Dry Measure.

1. For what is Dry Measure used?

Dry measure is used in measuring all dry articles, such as grain, fruits, roots, salt, coal, &c.

2. What are its denominations?

Its denominations are chaldrons, bushels, pecks, quarts, and pints.

3. Repeat the table.

TABLE.

2	pints, *pt.*	make	1	quart, - - -	*qt.*
8	quarts - - - -		1	peck, - - -	*pk.*
4	pecks - - - -		1	bushel, - -	*bu.*
36	bushels - - -		1	chaldron, - -	*ch.*

LESSON XIV.

Time.

1. What are the denominations of Time?

The denominations of time are years, months, weeks, days, hours, minutes, and seconds.

2. Repeat the table.

TABLE.

60 seconds, *sec.*	make	1 minute, marked	*m.*
60 minutes - - - -		1 hour, - - -	*hr.*
24 hours - - - -		1 day, - - -	*da.*
7 days - - - -		1 week, - - -	*wk.*
4 weeks - - - -		1 month, - -	*mo.*
13*mo.* 1*da.* and 6*hrs.*, or 365*da.* 6*hrs.*		1 common or Julian year,	*yr.*

3. How many calendar months in a year?

The year is divided into 12 calendar months, which contain an unequal number of days.

		Names.	*No. of Days.*
1	month	January, - - -	31
2	- - -	February, - - -	28
3	- - -	March, - - -	31
4	- - -	April, - - - -	30
5	- - -	May, - - - -	31
6	- - -	June, - - - -	30
7	- - -	July, - - - -	31
8	- - -	August, - - -	31
9	- - -	September, - -	30
10	- - -	October, - - -	31
11	- - -	November, - -	30
12	- - -	December, - -	31
		Total	365

4. How do you remember which of the months have 30 days, and which 31?

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Excepting February, twenty-eight alone.

LESSON XV.

Circular Measure or Motion.

1. For what is Circular Measure used?

Circular measure is used in estimating latitude and longitude, and also in measuring the motions of the heavenly bodies.

2. How is every circle supposed to be divided?

Every circle is supposed to be divided into 360 equal parts, called degrees. Each degree is divided into 60 minutes, and each minute into 60 seconds.

3. Repeat the table.

TABLE.

60	seconds ″	make	1	minute,	marked ′.
60	minutes - -		1	degree, - - -	°.
30	degrees - -		1	sign, - - -	s.
12	signs or 360° -		1	circle, - - -	c.

TABLE OF PARTICULARS.

12	things	make	1	dozen.
12	dozen - - - - - -		1	gross.
12	gross, or 144 dozen -		1	great gross.

ALSO,

20	things	make	1	score.
112	pounds - - - - - -		1	quintal of fish.
24	sheets of paper - -		1	quire.
20	quires - - - - - -		1	ream.

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